supply, health, and engineering and architectural services. In addition to growth, job openings will result from the need to replace materials engineers who transfer to other occupations or leave the labor force.

Earnings
Median annual earnings of materials engineers were $57,970 in 1998. The middle 50 percent earned between $43,890 and $77,730. The lowest 10 percent earned less than $34,890 and the highest 10 percent earned more than $89,600. In the Federal Government, materials engineers in supervisory, nonsupervisory, and management positions averaged $68,000 a year in early 1999.

According to a 1999 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in materials engineering received starting offers averaging about $43,400 a year.

(See introduction to the section on engineers for information on working conditions, training requirements, and sources of additional information.)

Mechanical Engineers

(O*NET 22135)

Nature of the Work
Mechanical engineers research, develop, design, manufacture and test tools, engines, machines, and other mechanical devices. They work on power-producing machines such as electricity-producing generators, internal combustion engines, steam and gas turbines, and jet and rocket engines. They also develop power-using machines such as refrigeration and air-conditioning equipment, robots used in manufacturing, machine tools, materials handling systems, and industrial production equipment. Mechanical engineers also design tools needed by other engineers for their work.

Mechanical engineers work in many industries and their work varies by industry and function. Some specialties include applied mechanics; computer-aided design and manufacturing; energy systems; pressure vessels and piping; and heating, refrigeration, and air-conditioning systems. Mechanical engineering is the broadest engineering discipline, extending across many interdependent specialties. Mechanical engineers may work in production operations, maintenance, or technical sales; many are administrators or managers.

Mechanical engineers increasingly use computers to perform modeling and simulation.

Employment
Mechanical engineers held about 220,000 jobs in 1998. Almost 3 out of 5 jobs were in manufacturing—mostly in machinery, transportation equipment, electrical equipment, instruments, and fabricated metal products industries. Engineering and management services, business services, and the Federal Government provided most of the remaining jobs.

Job Outlook
Employment of mechanical engineers is projected to grow about as fast as the average for all occupations though 2008. Although overall manufacturing employment is expected to decline, employment of mechanical engineers in manufacturing should increase as the demand for improved machinery and machine tools grows and industrial machinery and processes become increasingly complex. Employment of mechanical engineers in business and engineering services firms is expected to grow faster than average as other industries in the economy increasingly contract out to these firms to solve engineering problems. In addition to job openings from growth, many openings should result from the need to replace workers who transfer to other occupations or leave the labor force.

Earnings
Median annual earnings of mechanical engineers were $53,290 in 1998. The middle 50 percent earned between $42,680 and $74,220. The lowest 10 percent earned less than $35,290 and the highest 10 percent earned more than $87,000. Median annual earnings in the industries employing the largest numbers of mechanical engineers in 1997 were:

Federal government	$66,800
Engineering and architectural services	55,800
Electronic components and accessories	52,900
Aircraft and parts	51,800
Motor vehicles and equipment	48,500

According to a 1999 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in mechanical engineering received starting offers averaging about $43,300 a year; master's degree candidates, $51,900; and Ph.D. candidates, $64,300.

(See introduction to the section on engineers for information on working conditions, training requirements, and sources of additional information.)

Mining Engineers, Including Mine Safety Engineers

(O*NET 22108)

Nature of the Work
Mining engineers find, extract, and prepare coal, metals, and minerals for use by manufacturing industries and utilities. They design open pit and underground mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods for transporting minerals to processing plants. Mining engineers are responsible for the safe, economical, and environmentally sound operation of mines. Some mining engineers work with geologists and metallurgical engineers to locate and appraise new ore deposits. Others develop new mining equipment or direct mineral processing operations to separate minerals from the dirt, rock, and other materials with which they are mixed. Mining engineers frequently specialize in the mining of one mineral or metal, such as coal or gold. With increased emphasis on protecting the environment, many mining engineers work to solve problems related to land reclamation and water and air pollution.

Mining engineers often spend time outdoors at work sites.

Employment
Mining engineers held about 4,400 jobs in 1998. While one-half worked in the mining industry, other mining engineers worked in government agencies, manufacturing industries, or engineering consulting firms.

Mining engineers are usually employed at the location of natural deposits, often near small communities, and sometimes outside the United States. About one-third of mining engineers employed in the U.S. work in Nevada, Colorado, Arizona, West Virginia, and Wyoming. Those in research and development, management, consulting, or sales, however, are often located in metropolitan areas.

Job Outlook
Employment of mining engineers is expected to decline through 2008. Most of the industries in which mining engineers are concentrated—such as coal, metal, and mineral mining, as well as stone, clay, and glass products manufacturing—are expected to experience declines in employment.

Although there are no job openings expected to result from employment growth, there should be openings resulting from the need to replace mining engineers who transfer to other occupations or leave the labor force. A large number of mining engineers currently employed are approaching retirement age. In addition, there are a relatively small number of schools offering mining engineering programs, and the small number of graduates is not expected to increase.

Mining operations around the world recruit graduates of U.S. mining engineering programs. Consequently, job opportunities may be better worldwide than within the United States. As a result, graduates should be prepared for the possibility of frequent travel or even living abroad.

Earnings
Median annual earnings of mining engineers were $56,090 in 1998. The middle 50 percent earned between $43,350 and $75,650. The lowest 10 percent earned less than $34,930 and the highest 10 percent earned more than $87,380. In the Federal Government, mining engineers in supervisory, nonsupervisory, and management positions averaged $62,300 a year in early 1999.

According to a 1999 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in mining engineering received starting offers averaging about $39,600 a year.

(See introduction to the section on engineers for information on working conditions, training requirements, and sources of additional information.)

Nuclear Engineers

(O*NET 22117)

Nature of the Work
Nuclear engineers research and develop the processes, instruments, and systems used to derive benefits from nuclear energy and radiation. They design, develop, monitor, and operate nuclear plants used to generate power. They may work on the nuclear fuel cycle—the production, handling, and use of nuclear fuel and the safe disposal of waste produced by nuclear energy—or on fusion energy. Some specialize in the development of nuclear power sources for spacecraft; others develop industrial and medical uses for radioactive materials, such as equipment to diagnose and treat medical problems.

Employment
Nuclear engineers held about 12,000 jobs in 1998. About 60 percent were in utilities, the Federal Government, and engineering consulting firms. More than half of all federally employed nuclear engineers were civilian employees of the Navy, and most of the rest worked for the Department of Energy or the Tennessee Valley Authority. Most nonfederally employed nuclear engineers worked for public utilities or engineering consulting companies. Some worked for defense manufacturers or manufacturers of nuclear power equipment.

Many nuclear engineers work for public utilities.